The Monthly Evening Sky Map

A JOURNAL FOR THE AMATEUR — FOUNDED BY THE LATE LEON BARRITT
—NORTHERN AND SOUTHERN HEMISPHERE—

ALSO A STAR, CONSTELLATION AND PLANET FINDER MAP ARRANGED FOR THE CURRENT MONTHS — JAN. - FEB. - MAR. MORNING AND EVENING — AND PRACTICAL ANYWHERE IN THE WORLD

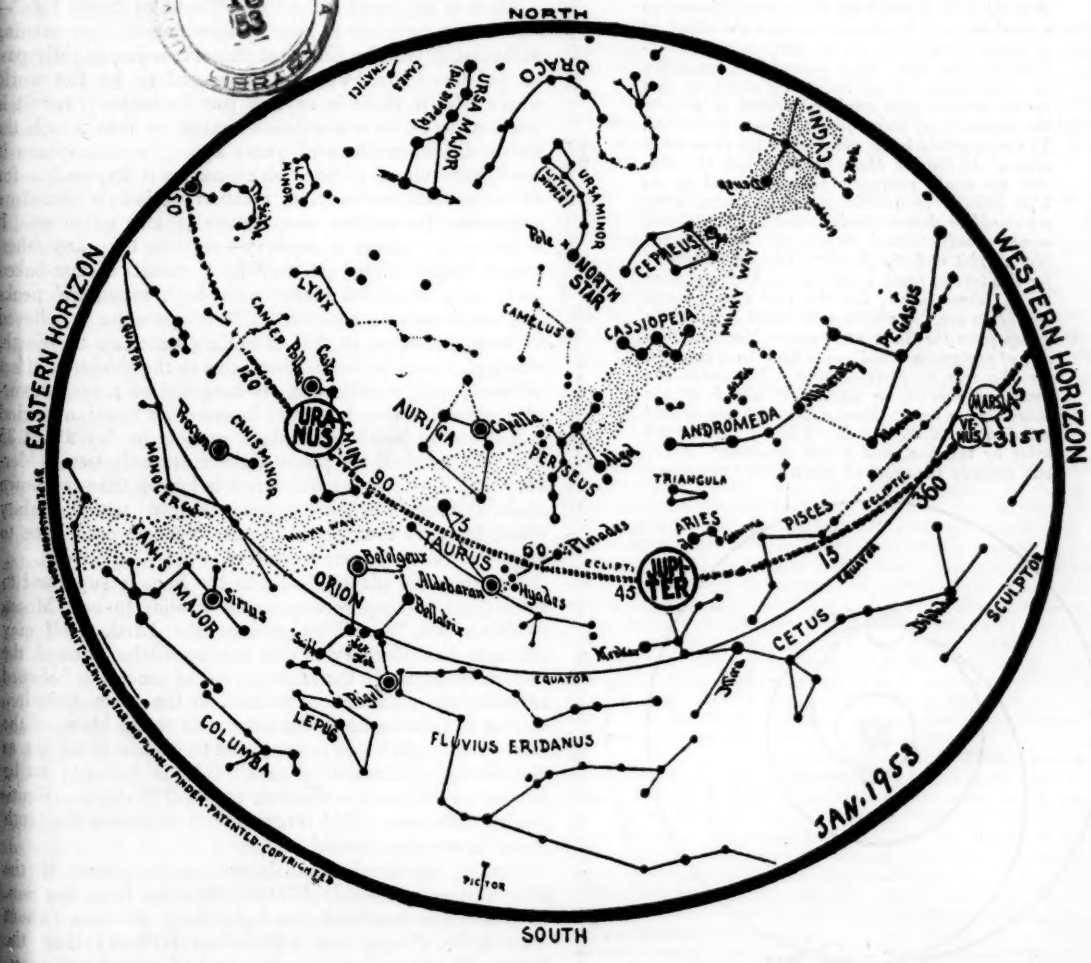
PUBLISHED QUARTERLY

Largest Circulation of any Amateur Astronomical Journal in the World

Entered as second class matter, at Shohola, Pennsylvania, under the act of March 5, 1879

Vol. XLVII Whole No. 475 SHOHOLA, PA., JANUARY-FEBRUARY-MARCH, 1953 $2.00 PER YEAR 60 Cts. Per Copy

EVENING SKY MAP FOR JANUARY



Face South And Hold The Map Overhead. The Top North And You Will See The Stars And Planets Just As They Appear In The Heavens. The Arrow Through The Two Stars In The Bowl Of The Big Dipper Points To The North Star. The Star At The End Of The Little Dipper.

AT 9:00 P.M., JAN. 1; 8:00 P.M., JAN 15; 7:00 P.M., JAN. 31.

This map is arranged specifically for Latitude 40 North—New York—but is practical for ten or fifteen degrees north or south of this latitude anywhere in the United States, the southern portion of Canada and the northern portion of Mexico and for corresponding latitude in Europe.

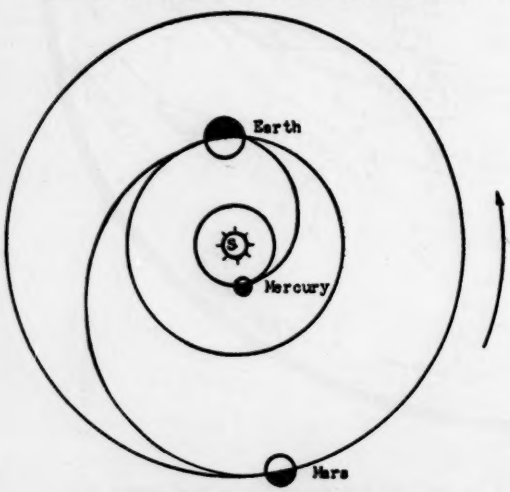
"The Coming Conquest of Space"

"The Coming Conquest of Space" was written in 1946 by Harry Akers, Jr., at the age of 12½, as a social science assignment in Balboa Junior High School, Balboa Heights, Canal Zone. It was first published in the Monthly Evening Sky Map in 1946-1948. In 1952, the author, now a student at Colorado School of Mines, Golden, Colorado, at the request of the editors of the MONTHLY EVENING SKY MAP, revised and enlarged the article by means of foot notes. The original text appears in normal type, the recently-added foot notes in italic type.

(*Continued from last issue*)

After we have satisfactorily answered the question *Is there Life on Mars ?* and have taken photographs and picked up mineral, plant, and animal (?) specimens, we must return to the Earth. However, more space-voyages lie ahead of us. Mars will still be near opposition, and we will be travelling towards the Sun. The velocity of escape from Mars is only 3.2 miles per second, but, since we can make our ship go faster, we should do so, to get back to the Earth faster. We are now back on Earth, and have disappointed many people who still believe that there are intelligent beings on Mars. We have, however, answered a very important scientific question.

Returning to Earth from Mars while Mars is at opposition would cause us to reach the Earth at a speed of 26 miles per second, under the influence of the Sun. Since it would be impossible to slow down by air resistance alone at this speed, another plan would be needed to prevent the necessity of using fuel to brake our speed. The plan would be to place our ship in an orbit around the Sun, at Mar's distance from the Sun. But we would purposely have too small an orbital velocity to remain at this distance. Thus we would be drawn slowly towards the Sun, and would slowly "slide" across the gap between Mar's orbit and the Earth's. The time required for this type of route would be much greater than for the direct route, but the fuel saving would justify its use. A similar plan could be used for a trip from the Earth to Venus or Mercury. This sort of navigation could easily have been reversed for the trip to Mars—taking off towards the zenith at sunrise, so as to get ahead of the Earth in its orbit. Having too high an orbital velocity, we could not be held in the Earth's orbit by the Sun, and would gradually "slide" out towards the orbit of Mars. (*See diagram.*)



ALTERNATE ROCKET ROUTES

In this diagram, Venus has been omitted to reduce the size of the drawing. Possible rocket routes for trips to Mercury and Mars are shown. For a trip to Mars, we would take off towards the zenith at sunrise, getting ahead of the Earth in its orbit. Travelling too fast to remain in the Earth's orbit, we would tend to drift away from the Sun, towards the orbit of Mars. If our route were carefully planned and established, by the time we reached the orbit of Mars the Sun would have slowed us down to the orbital speed of Mars, so that braking would require only a small amount of fuel.

The return trip from Mars would be made in a manner similar to the trip to Mercury shown here. By taking off towards the zenith at sunset, we would fall behind the Earth; going too slowly, we would be drawn in towards the Sun. Again, if our route had been correctly established at the very beginning, we would have accelerated to the orbital speed of Mercury by the time we reached its orbit. Note that a trip to Mars would *not* be planned to coincide exactly with an opposition, and that the time required for the trip would be of the order of six months. These routes could be substituted for the more direct routes to save fuel.

CHAPTER VI TRIPS TO OTHER PLANETS

The planet Venus is our nearest planetary neighbor, with a smallest distance of 26,000,000 miles.

Mars is supposed to be "The World of Spent Life"—the world where life is near its termination, just existing in its last days. The Earth, at present, is just slightly past its prime of life. Venus is supposed to be the world where life, if there is any, is just in infancy, for it is believed to be in a condition similar to that which the Earth was in millions of years ago. Its atmosphere is constantly full of clouds, which makes it impossible for us to see its surface; its rotation period is therefore unknown. Its surface temperature is also unknown. It is certainly a planet of mystery—more so than any other, except frigid Pluto. It may be a desert of sun-baked rock, or a beautiful planet with high mountain peaks and water—what a contrast !! Its temperature is believed to be about equal to that of boiling water on the Earth, although it may be much lower, due to the shielding effect of the cloudy atmosphere. It may not be a very favorable place for life, however, because its rotation period is believed to be about 30 days, making its day about 35 days long. Of all the planets, there are only two— Mercury and Pluto, about which less is known than is known about Venus. Perhaps more is known with certainty about Mercury than about Venus. Venus would have to yield its secrets to our explorers.

Mercury, the planet closest to the Sun, is supposed to be a dead, atmosphereless world similar to our Moon, as Mars will "soon" be, and as the Earth itself may someday be. Mercury makes one revolution around the Sun in 88 days. In the same period of time, it is *believed* to make one rotation on its axis, in the same direction, so that it always shows the same side to the blaze of the Sun. The "light" side is supposed to be nearly as hot as melted tin, while the "dark" side is believed to be almost as cold as the absolute zero (-273 degrees Centigrade). Mercury could reveal to our explorers the truth about its rotation period.

Jupiter, the heaviest and largest of the planets in the solar system, is roughly 450,000,000 miles from the Sun. It gets much less heat and light from the Sun (about 4.1% at its closest, and 3.4% when farthest) than the Earth. Its atmosphere is composed of poisonous gases, and contains no oxygen, the oxygen having been frozen and deposited on the planet's surface. The planet's rocky inner core is supposed to be covered with ice. When the planets were hot, gases, among them water vapor, were given off. The small planets lost these gases, but the larger planets retained them. On the inner, warmer

planets, the water vapor condensed, but all of it did not freeze. On the outer planets, the water froze, carrying with it more poisonous gases. The dimensions for the various sections of Jupiter are as follows:

Rocky Core	22,000 miles in radius
Ice Layer	16,000 miles thick
Atmosphere	6,000 miles thick

Jupiter, a planet with a gaseous surface, and with currents in the surface, which cause certain sections to rotate faster than others, is very difficult to conceive of. Would our ship be able to find a solid surface to land on ? Or would it have to go through miles and miles of opaque gases—the very surface of the planet—before we could find even a semi-solid surface ?

We would certainly have to wear strong suits when taking a walk on Jupiter. The air pressure would crush us otherwise. Also, the gravity is known to be at least "2.65", meaning that a person weighing 200 pounds on Earth would weigh 530 pounds on Jupiter.

Clouds hang low over the surface. We would probably have to walk through them—if the surface could hold us up, and the gravitational pull would not be too great for us—and they might even be similar to fog on Earth—opaque. To better our picture of what the surface is like, we would have to go there.

Saturn, the handsomest planet, is about 850,000,000 miles from the Sun, and receives between 1/4 and 1/3 as much heat and light from the Sun as Jupiter does. (This amount of heat decreases as the *inverse SQUARE* of the distance. A body situated at a distance of 200,000,000 miles from the Sun would get only 1/4 as much heat (and light) as one situated at a distance of 100,000,000 miles.) The dimensions for its different layers are startling:

Rocky Core	14,000 miles in radius
Ice Layer	6,000 miles thick
Atmosphere	16,000 miles thick

The atmosphere and surface of Saturn are similar to those of Jupiter.

The rings of Saturn are a beautiful sight to behold. They are composed of tiny moonlets, and from the surface of Saturn appear as three bands of light across the sky. But beware ! ! Saturn's rings are composed of tiny bits of rock which rush around the planet; there are often collisions between two particles, and when that happens, tiny bits of ring come crashing down onto the planet's surface. Perhaps Saturn could yield the secret of how they came to be. In addition to the millions of tiny moons, there are nine or ten "regular" moons. These, on one single night, might be visible "strewn" through the sky, all in different phases. There would often be eclipses of the moon, eclipses of the Sun by the moons, and eclipses of farther moons by nearer moons. The same thing would be viewed from Jupiter, with its moons, only it would not be as interesting, for while Jupiter has 11 moons, only five could easily be seen from the planet's surface; the outer ones are very tiny. Jupiter and Saturn have one or two moons each which are similar to Mar's Deimos—ones which spend more than two of the planet's days crossing the sky. But no other planet in the solar system has one similar to Mars's Phobos—one which makes one revolution around its parent planet in a period shorter than that in which the planet rotates on its axis, thus rising in the West and setting in the East. Photographs of eclipses and the varied aspects of the moons of Saturn and Jupiter would be valuable. We might, also, want to land on some of the moons themselves. From Mimas, Saturn's innermost moon, Saturn covers about a fourth of the sky. How beautiful it would be if anyone were on Mimas. Even from Phoebe, the outermost moon, with a distance of 8,000,000 miles from the planet, Saturn appears the size of the Earth's Moon. Titan, Saturn's largest moon, with a diameter of about 3,000 miles, has an atmosphere similar to that of its parent planet, only a much thinner one; the sky therefore appears blue instead of black, as on all the other moons. A trip to Saturn therefore, would certainly be profitable.

If a large enough ocean were available, Saturn could be floated *on it. Because of its thick atmosphere, its over-all density is less than that of water.*

Uranus, the fourth planet in order of size, reckoned from the largest, comes next after Saturn. Its heat and light are only 0.3% as much as the corresponding values for the Earth, even at perihelion, while at aphelion they are only about 1/4% as great. Uranus has four moons. We would go to Uranus to see what its surface is like, for no surface markings are visible.

Neptune, the third largest planet, is never closer to the Sun than 2,769,600,000 miles, and receives only 0.1% as much heat as the Earth. It has one moon, Triton, and may have another one.

As of 1951, *Jupiter was known to have* 13 *moons, Uranus five, and Neptune two.*

An odd thing about Pluto is that, although its greatest distance from the Sun is over 4 billion miles as compared with less 3 billion miles for Neptune, its least distance is *less* than that of Neptune—2,750,000,000 miles. Nothing is known about its surface. It is believed to be the densest and the second smallest planet. Its diameter is 3,600 miles.

We may not expect to find life on Mercury or the five outermost planets. Jupiter, Saturn, Uranus, Neptune, and Pluto are far too cold for life, and their atmospheres are unsuitable. Venus and Mars may have scanty life.

We have now paid a visit to every planet in the Solar system. We have answered many of science's questions about our neighboring planets. We are now ready to turn elsewhere in the universe for exploration.

To be continued next issue

IMAGINATIVE VIEW OF THE UNIVERSE

By Carlos Pardo

A sphere may be made out of earth, which, as a matter of course, would contain lumps of earth or stones. If the sphere be made to revolve, the earth would vibrate; all and everyone of the stones would rotate, keeping their respective position, so that if a worm or any other insect capable of seeing, were to be placed on one of the stones would see no other change than the rotary vibrations. Between these grains of earth and the stones there is space, exceedingly reduced, but sufficient to allow vibrations.

Let us suppose the universe to be this sphere of earth; The infinite interstellar matter; that is, the matter between the stars, equivalent to the stones, would be as the earth in the sphere. The stars, Planets and Satelites, comets, aerolites and any other body in space are the stones. The Celestial sphere rotates on its own axis; the whole universe rotates, and the vibrations are represented by the movements of the rotation and translation of all the bodies, with their definite and limited orbits, which, owing to the enormous interstellar distances are inappreciable to the sight, and even to the most accurate instruments, which stability is really as much as that of all stones within the earth's sphere. In other words no matter how extended be the orbits of the bodies around their respective centers of gravity the space between those bodies and their centers, reduces itself—The different centers will have a homogeneous rotary movement, which preserves the stability of the position of the Stars, forming the constellations, forever before us.

$2.00 Per Year. Postpaid in the United States
PUBLISHED QUARTERLY

Subscriptions received by Booksellers and Opticians everywhere
Canada $3.00; Foreign $3.00

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Please make checks payable to "The Monthly Evening Sky Map"

Box 3, Pike County, Shohola, Pa.
Telephone Milford 2310

Vol. XLVII Shohola, Pa., Jan.-Feb.-Mar., 1953

AMATEUR'S FORUM

By IRVING L. MEYER, M. S.

January 1953

THE SUN: travels from Sagittarius into Capricornus with a slowly accelerating northward motion. The earth is in perihelion (closest to the Sun) the 2nd at a distance of 91.3 million miles.

THE MOON: is at apogee (farthest from the earth) the 4th at 252,000 miles distance, and is at perigee (closest) the 16th at 224,000 miles.

The Moon's phases (E. S. T.) :

Last Quarter	January 8 at 5:09 AM
New Moon	15 at 9:08 AM
First Quarter	22 at 12:43 AM
Full Moon	29 at 6:44 PM.

There will be a total eclipse of the Moon on January 29th. This eclipse will be visible over most of Europe, Africa, the North and South Atlantic Oceans, and North and South America. The circumstances of the eclipse follow (E. S. T.) :

Moon enters penumbra	January 29 at 3:40 PM
Moon enters umbra	29 at 4:54 PM
Total eclipse begins	29 at 6:05 PM
Middle of eclipse	29 at 6:47 PM
Total eclipse ends	29 at 7:30 PM
Moon leaves umbra	29 at 8:40 PM
Moon leaves penumbra	29 at 9:55 PM

The magnitude of the eclipse is 1.337, where the Moon's diameter is 1.0.

MERCURY : is a morning star all month, too close to the Sun for satisfactory observation. It moves from Ophiuchus through Sagittarius into Capricornus, and geocentric distance reaches a maximum of 132 million miles on the 25th.

VENUS : moves from Capricornus through Aquarius to a point close to the equator on the Pisces boundary. It is in the evening sky all month, very well placed for observation in the early evening sky. It reaches greatest elongation east of the Sun, 46° 54', on the 31st. Distance decreases during the month from 85 to 65 million miles, causing an increase in apparent diameter from 18" to 24". Also, brightness increases from -3.8 magnitude to -4.0, making this the brightest star-like object by far. It averages a little over one-half illuminated during the month, thus appearing like the Moon a day past first quarter.

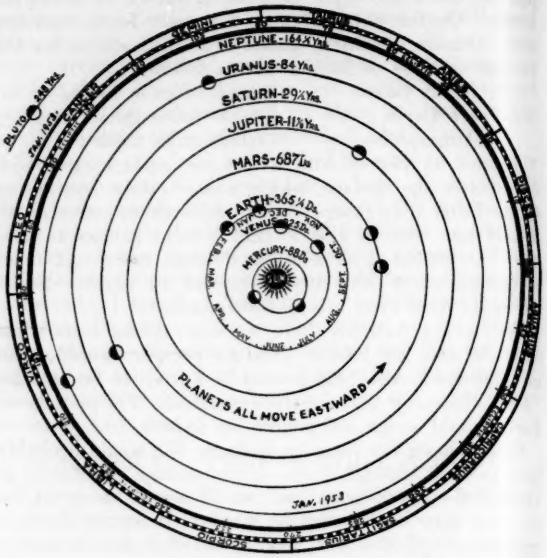
MARS : is also in the evening sky, moving from Aquarius to the Pisces boundary. It is no longer well placed for observation. Magnitude averages 1.3, apparent diameter 5", and distance increases from 167 to 183 million miles. It is in close conjunction with Venus on the 17th, with Venus 12" north (a separation equal to about 40% of the Moon's diameter).

JUPITER : in Aries, sets about midnight in the evening sky. It is still an interesting object satisfactorily placed for observation. The most modest optical aid will reveal its flattened disc and four brightest satellites; a small telescope will show up the cloud-band markings on the disc. On the 15th, distance is 430 million miles, magnitude is -2.1 (second only to Venus in brightness), and equatorial diameter is 42.5".

SATURN : is in Virgo in the morning sky, rising at about midnight. It is becoming better situated for observation every day, and at the 15th 899 million miles away; magnitude is 0.9; ring diameter is 39"; and the equatorial diameter of the planets disc is 17.3". Small telescopes will reveal the partially-opened (as seen from the earth) ring system.

URANUS : is well placed for observation in Gemini, coming to opposition to the Sun the 6th. At this time it is closest to the earth (1651 million miles distance) and apparent diameter is 3.9". It is a little brighter than magnitude 6.0 and can be spotted with the unaided eye on a moonless night. In the telescope, 50 diameters magnification will reveal its neat, round disc.

NEPTUNE : near Saturn in Virgo, this 8th magnitude object also rises near midnight. It cannot be seen with the unaided eye, but can be located readily with even the smallest telescope. It is becoming better situated for observation. Geocentric distance the 15th is 2813 million miles.



Orbits and Heliocentric Movements of the Planets

NOTE: The planets are shown in their respective orbits. Two positions, one for the first, and one for the last day of the month, are given for Mercury, Venus and Mars. The arrow indicates the last day of the month. Jupiter, Saturn, Uranus and Neptune are shown in the mean position for the current month.

PLANETARY CONFIGURATIONS

Eastern Standard Time

January, 1953

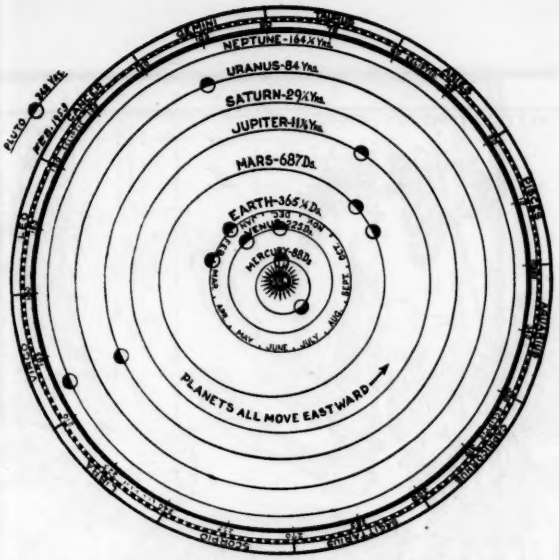
Jan.	2— 1:	AM	Earth in perihelion
Jan.	4— 6:	AM	Mercury in descending node
Jan.	5— 2:	PM	Jupiter stationary in Right Ascension
Jan.	6— 9:	PM	Opposition, Uranus and Sun
Jan.	8— 9:57	PM	Conjunction, Neptune and Moon; Neptune north 7° 13'
Jan.	9— 3:57	AM	Conjunction, Saturn and Moon; Saturn north 8° 8'
Jan.	14— 3:	AM	Quadrature, Neptune and Sun
Jan.	14—12:02	PM	Conjunction, Mercury and Moon; Mercury north 1° 32'
Jan.	14— 1:	PM	Mercury in aphelion
Jan.	17— 4:	AM	Quadrature, Saturn and Sun
Jan	17— 9:	PM	Conjunction, Venus and Mars; Venus north 0° 12'
Jan.	18— 7:31	PM	Conjunction, Mars and Moon; Mars south 4° 2'
Jan.	18— 8:31	PM	Conjunction, Venus and Moon; Venus south 3° 48'
Jan.	22— 9:23	PM	Conjunction, Jupiter and Moon; Jupiter south 6° 37'
Jan.	24— 8:	PM	Venus in ascending node
Jan.	25—11:	AM	Neptune stationary in Right Ascension
Jan.	27— 6:07	PM	Conjunction, Uranus and Moon; Uranus south 1° 59'
Jan.	29—		Total eclipse of Moon
Jan.	31—10:	AM	Venus greatest elongation east, 46° 54'

PLANETARY CONFIGURATIONS

Eastern Standard Time

February, 1953

Feb.	1— 4:	AM	Quadrature, Jupiter and Sun
Feb.	2— 6:	PM	Superior conjunction, Mercury and Sun; Mercury south 2° 5'
Feb.	3— 9:	PM	Mercury greatest heliocentric latitude south
Feb.	5— 5:33	AM	Conjunction, Neptune and Moon; Neptune north 7° 18'
Feb.	5—12:52	PM	Conjunction, Saturn and Moon; Saturn north 8° 19'
Feb.	5— 9:	PM	Saturn stationary in Right Ascension
Feb.	10— 8:	PM	Opposition, Pluto and Sun
Feb.	14—		Partial eclipse of Sun
Feb	14— 2:16	PM	Conjunction, Mercury and Moon; Mercury south 3° 48'
Feb.	16— 5:41	PM	Conjunction, Mars and Moon; Mars south 5° 12'
Feb.	17— 3:51	AM	Conjunction, Venus and Moon; Venus south 2° 14'
Feb.	19— 8:45	AM	Conjunction, Jupiter and Moon; Jupiter south 6° 26'
Feb.	22—10:	PM	Mercury in ascending node
Feb.	23—10:13	PM	Conjunction, Uranus and Moon; Uranus south 2° 2'
Feb.	27— 1:	PM	Mercury in perihelion
Feb.	27— 3:	PM	Venus in perihelion



Orbits & Heliocentric Movements of the Planets for February 1953

AMATEUR'S FORUM

FEBRUARY, 1953

THE SUN : moves from Capricornus into Aquarius. Distance the 1st is 91.5 million miles; the 28th is 92.0 million miles.

There is a partial eclipse of the Sun on the 13th, invisible in the United States, but visible over most of eastern Asia, part of the western Pacific Ocean, and most of Alaska. The magnitude of the greatest eclipse is 0.76, where the Sun's diameter is 1.0.

THE MOON : is farthest from the earth twice during the month—on the 1st at 252,000 miles distance, and the 28th at 252,000 miles; it is closest the 14th at 222,000 miles.

The Moon's phases (E. S. T.) :

Last Quarter	February	6 at 11:09 PM
New Moon		13 at 8:10 PM
First Quarter		20 at 12:44 PM
Full Moon		28 at 1:59 PM

MERCURY : is in superior conjunction with the Sun on the 2nd, thereupon entering the evening sky. It moves from Capricornus through Aquarius into Pisces, and will be visible low in the west shortly after sunset, the last few days of the month. At this time, magnitude will be -0.6 and apparent diameter about 6". Moderate power on a telescope (preferably used with setting circles in full daylight) will reveal a half moon appearance. Distance decreases from 131 million miles the 1st, to 92 million miles the 28th.

VENUS : is in Pisces all month, well placed for observation in the evening sky. During the month distance decreases from 64 to 46 million miles; apparent diameter correspondingly increases from 24" to 34"; Magnitude increases from -4.0 to -4.3; and the area of the illuminated disc, as seen from earth, decreases from about 50% to 34%—showing as a crescent in the telescope.

MARS : is slowly being overtaken by the Sun in the evening sky. It is in Pisces all month, poorly situated for observation. Distance the 1st is 184 million miles, against 198 million miles the 28th.

JUPITER : in the evening sky in Aries, is still fairly well placed for observation, though it sets rather early in the evening. Distance the 15th is 476 million miles.

SATURN : rises a few hours after sunset, from a point near Spica in Virgo. It is becoming increasingly better placed for observation. On the 15th distance is 853 million miles and magnitude is 0.7.

URANUS : is above the horizon most of the night, setting shortly before dawn from its location in Gemini. It is close to the limit of naked-eye visibility. Distance the middle of the month is 1672 million miles.

NEPTUNE : is a morning sky object in Virgo, close to Saturn and Spica. It is not visible to the naked eye, and can best be located by plotting its positions on a detailed star chart. Distance the 15th is 2765 million miles.

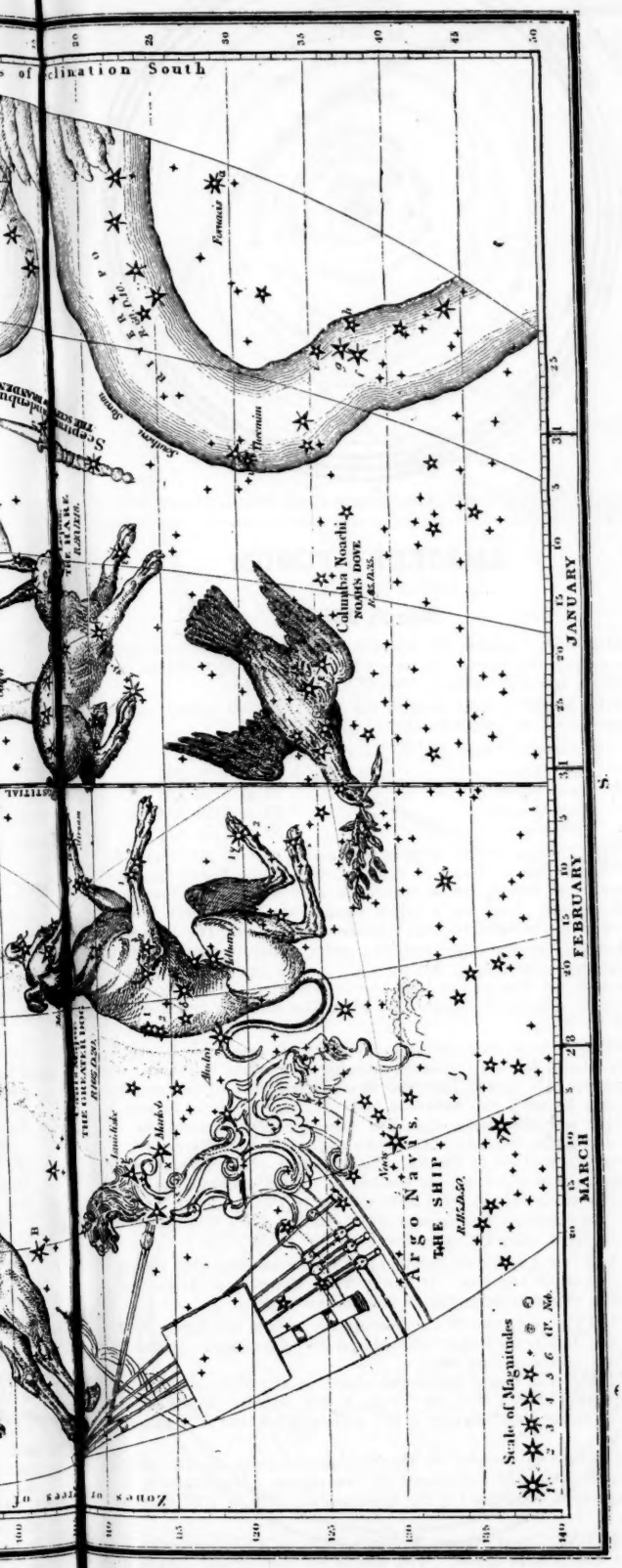
PLUTO : this is the most remote, and the faintest, of the known major planets of our solar system. High in the sickle of Leo, it comes to opposition the 10th. On that date geocentric distance is a staggering 3210 million miles, making it too weak an object for all but sizeable telescopes.

MORNING SKIES FOR JAN. - FEB. - MAR

AT 5 A. M., JAN. 1; 4 A. M., JAN. 15; 3 A. M. JAN. 31.
AT 5 A. M., FEB. 1; 4 A. M., FEB. 15; 3 A. M., FEB. 28.
AT 5:15 A.M., MAR. 1; 4:15 A.M. MAR. 15; 3:45 A.M. MAR. 31.

MAP III.

THE CONSTELLATIONS



USE FOR AMATEUR TELESCOPES

DECEMBER TO FEBRUARY

One who has made his own telescope has many opportunities to observe the wonders and curiosities of the sky, but everyone can learn something of many of these objects. Celestial objects visible to the naked eye, or in a pair of field glasses, can be studied and enjoyed without the aid of a telescope. Then beyond the naked eye objects are the details of the Hyades and the Pleiades, and the other marvels of the Milky Way. These beauty spots, which include the galactic star clusters, globular star clusters, diffuse and planetary nebulae, thrill the observer no matter how many times he finds them in his field of vision. But when he has enjoyed these wonders of our galaxy—the Milky Way system of stars—he has just begun to reach out into space. The most distant object in our galaxy visible in an amateur telescope is NGC (New General Catalogue) No. 7006 (Right Ascension 20th 57min, Declination 15° 48'—North) a globular cluster, magnitude 11.8, easily visible in a 6-inch telescope on a clear, dark night. Its distance, as given in Harlow Shapley's book, "Star Clusters," is 56.8 kiloparsecs, which means 185,111 light years. This distance may be too great due to the recently discovered galactic obscurations of cosmic dust, or drifting nebulosity.

But far beyond our galaxy are other galaxies and clusters of galaxies to stagger the imagination. The most distant of these extragalactic objects so far observed—not visually but photographically—is "of the order of 500 million light years." Galaxies of this tremendous distance are shown in a photograph in "The Realm of the Nebulae," by Edwin Hubble. The author indicates only one of these on the plate, but it is easy to pick out at least a dozen others. Looking the same distance in the opposite direction from which this picture was taken gives the observable universe the stupendous expanse of a billion light years. And this is probably only a step into limitless space.

A galaxy is an organized aggregation of stars held together by gravitational attraction. The stars of the group revolve around a central nucleus, and the centrifugal force of this revolution increases the group's equatorial diameter and this, of course, decreases the axial diameter. The result is that most galaxies are shaped like an old-time wagon wheel with a large hub. (Our galaxy's equatorial diameter is about 200,000 light years and its axis about 40,000 light years.) The revolving movement of these objects has given them the name "spiral galaxies." But all galaxies are not spirals. There are spheroidal and irregular galaxies, like NGC 205 listed below, the Magellanic Clouds, NGC 6822, etc.

Our galaxy is a triple system, the companies being the two Magellanic Clouds. NGC 224 (see list) has two companions, NGC 221 and 205. NGC 5194, M. 51, (13h 27m, 47° 30'—N.), the "Whirlpool Nebula," the first galaxy discovered to be a spiral, has one companion. Just how many other galaxies are organized in groups will never be known because of their great distances. Also some galaxies may be composed of more than four systems.

Galaxies are thought to be separated by about one million light years. When in clusters their distances are perhaps somewhat less, though the clusters are separated by greater distances. In our own cluster NGC 6822 (19h 42m 14° 53'—S.) is only 625,000 light years from the sun. NGC 598 is 770,000 light years and NGC 224 is 805,000 light years. Another "nearby" galaxy is NGC 221 (00h 40m 40° 36'—N.). This is Messier 32, and is 700,000 light years distant.

Galaxies in outer space are assumed to be of uniform intrinsic brightness. Therefore apparent faintness indicates greater distance. Only within the last thirty or forty years has the distance of even the nearest of these objects been known. In fact, not until 100-inch telescope showed that the brighter "nebulae" were systems of stars floating through space far beyond the Milky Way system, was much progress made in estimating the distance of these outer "Milky Ways."

There are fifteen or twenty known clusters of galaxies, but in most of observable space galaxies seems to be uniformly distributed. The greatest clustering of these systems is in the constellations of Coma-Berenices, Virgo, and nearby regions.

There are some 230 galaxies brighter than the thirteenth magnitude north of the celestial equator, in the twelfth hour of Right Ascension. Most of these are estimated to be of the order of 7,000,000 to 10,000,000 light years—the fainter ones being the more remote.

Galaxies are found in all regions of space—hundreds of millions of them—except near the Milky Way. This does not mean that there are none in this direction, but merely that we cannot see them through the masses of stars of the Milky Way and the obscuring material on either side of it. In every direction in our sample of space—a globe of space 1,000 million light years in diameter—there are about 100 million systems of stars like our own Milky Way system, and they seem to be of comparable size and population.

By visual observation nearly all galaxies look like small clouds of nebulosity. For this reason early astronomers thought that they were clouds of nebulous material, so they called them "Nebulae." This name was also applied to distant globular star clusters and to diffuse and planetary nebulae. When photography came to the aid of astronomers all these objects, except the galaxies, were found to be in our own galaxy. Nebulae are only a very small part of a galaxy. So astronomers began calling them by their right name—"galaxies."

With amateur telescopes a number of galaxies can be observed and some estimates made of their distances. At this time of the year—December to February—some notable galaxies may be observed. Here are a few of those I have seen in this region of the sky:

205 *Andromeda*. 00h 38m 41° 25'—N. b 10.8, diameter 3'.0 x 3'.0, Spheroidal, nearly edgewise. It is a hazy patch near M. 31. Use low power.

598 (M. 33). *Triangulum*. 0131 3024—N. m 7.8, dia. 60'.0 x 40'.0. Spiral seen nearly broadside. Nearest of the spirals, except M. 32 referred to above. Distance 770,000 light years.

613 (H. I. 281). *Sculptor*. 0132 2940—S. m 11.1, dia. 4'.0 x 2'.0. Barred spiral seen nearly edgewise. Bright and interesting.

628 (M. 74). *Pisces*. 0134 1532—N. m 11.2, dia. 8'.0 x 8'.0. Spiral seen exactly broadside.

1300. *Eridanus*. 0317 1935—S. m 11.8, dia. 6'.0 x 3'.0. Barred spiral inclined about 50 percent from broadside.

There are a few other bright galaxies farther north, but my telescope does not reach north of 45° so I do not list them. Also in the region covered by the above list are many galactic star clusters, a few globular clusters, planetaries and diffuse nebulae.

PLANETARY CONFIGURATIONS

Eastern Standard Time

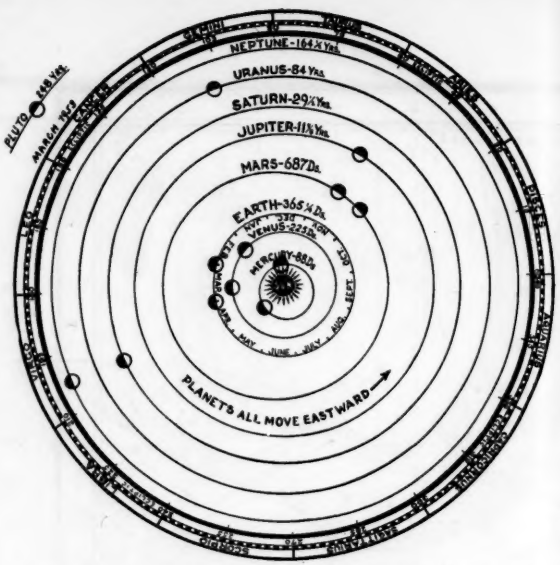
March 1953

Mar.	2— 3:	AM	Mercury greatest elongation east, 18° 10'
Mar.	4—10:57	AM	Conjunction, Neptune and Moon; Neptune north 7° 14'
Mar.	4— 5:47	PM	Conjunction, Saturn and Moon; Saturn north 8° 20'
Mar.	7— 7:	PM	Venus at greatest brilliancy
Mar.	8—11:	AM	Mercury stationary in Right Ascension
Mar.	9— 7:	PM	Mercury greatest heliocentric latitude north
Mar.	15— 2:54	PM	Conjunction, Mercury and Moon; Mercury south 0° 18'
Mar.	17— 2:58	PM	Conjunction, Mars and Moon; Mars south 5° 25'
Mar.	17— 3:06	PM	Conjunction, Venus and Moon; Venus north 1° 34'
Mar	17— 6:	PM	Conjunction, Venus and Mars; Venus north 7° 0'
Mar.	18— 8:	AM	Inferior conjunction, Mercury and Sun; Mercury north 3° 23'
Mar.	18—10:	AM	Mars in ascending node
Mar.	19— 1:08	AM	Conjunction, Jupiter and Moon; Jupiter south 6° 6'
Mar.	20— 5:01	PM	Sun enters Aries; Equinox
Mar.	21— 8:	AM	Venus greatest heliocentric latitude north
Mar.	21—11:	PM	Venus stationary in Right Ascension
Mar.	22—12:	AM	Saturn greatest heliocentric latitude north
Mar.	22 — 6:	PM	Uranus stationary in Right Ascension
Mar.	23— 3:57	AM	Conjunction, Uranus and Moon; Uranus south 1° 55'
Mar.	30— 7:	PM	Mercury stationary in Right Ascension
Mar.	31— 3:29	PM	Conjunction, Neptune and Moon; Neptune north 7° 8'
Mar.	31— 8:22	PM	Conjunction, Saturn and Moon; Saturn north 8° 16'

THE 48 CONSTELLATIONS OF THE SOUTHERN HEMISPHERE

THE 48 CONSTELLATIONS OF THE SOUTHERN HEMISPHERE

ANTILA, the air pump; APUS, the bird of paradise; ARA, the Alter; ARGO NAVIS, the ship (subdivided in CARINA, the keel; PUPPIS, the stern; VELA, the sail; and PAXIS, the compass); CAELUM, the chisel; CANIS MAJOR, the great dog; CANIS MINOR, the small dog; CENTAURUS, the centaur; CETUS, the whale; CHAMELEON, the cameleon; CIRCINUS, the compasses; COLUMBA, the dove; CORONA AUSTRALIS, the southern crown; CORVUS, the crow; CRATER, the cup; CRUX, the southern cross; DORADO, the goldfish; ERIDANUS, the river; FORNAX, the furnace; GRUS, the crane; HOROLOGIUM, the clock; HYDRA, the female watersnake; HYDRUS, the male watersnake; INDUS, the indian; LEPUS, the hare; LUPUS, the wolf; MENSA, the table-land; MICROSCOPIUM, the microscope; MONOCEROS, the unicorn; MUSCA, the fly; NORMA, the level; OCTANS, the octant; ORION, the hunter; PAVO, the peacock; PHOENIX, the bird of love; PICTOR, the easel; PISCIS, AUSTRALIS, the southern fishes; RETICULUM, the net; SCULPTOR, the sculptor; SEXTANS, the sextant; TELESCOPIUM, the telescope; TOUCAN, toucan; TRIANGULUM AUSTRALIS, the southern triangle; VOLANS, the sailfish.



Orbits and Heliocentric Movements of the Planets March, 1953

AMATEUR'S FORUM

By IRVING L. MEYER, M. S.

March, 1953

THE SUN : crosses the equator and enters the northern heavens during the month. It moves from Aquarius into Pisces, and distance increases from 92.1 to 92.8 million miles.

THE MOON : is at perigee the 14th (222,000 miles) and at apogee the 27th (252,000 miles).

The Moon's phases (E. S. T.) :

Last Quarter	March 8 at 1:26 PM
New Moon	15 at 6:05 AM
First Quarter	22 at 3:10 AM
Full Moon	30 at 7:55 AM

MERCURY : reaches greatest elongation east of the Sun, 18° 10', on the 2nd in Pisces. It remains close to the Pisces-Aquarius boundary all month, but is observable only for the first few days of the month. Look for a bright (magnitude -0.2) object low in the west in the twilight zone, shortly after sunset. The telescope will reveal its crescent-shaped disc under moderate magnification, as apparent diameter at this time is 7". It is in inferior conjunction with the Sun on the 18th, thereby entering the morning sky. Minimum geocentric distance of 56 million miles is reached the 22nd.

VENUS : is in Aries in the evening sky all month. It is excellently placed for observation, and achieves greatest brilliancy, of magnitude -4.3, on the 7th. During the early part of the month, a person knowing just where to look can see the planet in broad daylight with the naked eye. For telescope-users, observation is best during the daylight hours, since daylight tends to reduce the tremendous contrast of this exceedingly bright planet. Venus will appear as a crescent, as the amount of area illuminated as seen from the earth reduces from 33% the 1st to 7% the 31st. At the same time distance decreases from 45 million miles to 29 million and apparent diameter increases from 35" to 54".

MARS : is a relatively faint object in the evening sky, setting not long after the Sun. It moves from Pisces into Aries, and distance increases from 198 to 213 million miles.

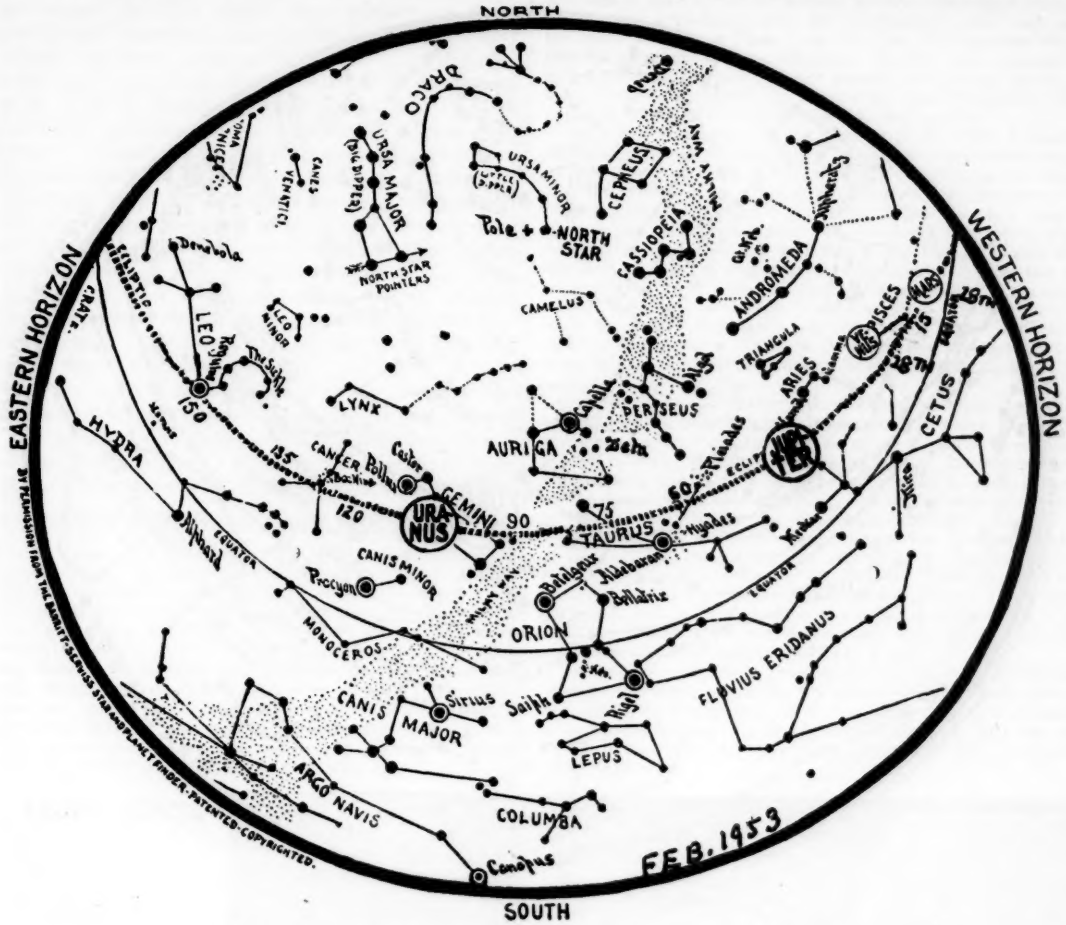
JUPITER : in Aries in the evening sky, sets a few hours after the Sun, and is no longer well placed for observation. Distance the 15th is 514 million miles.

SATURN : is now a prominent object in the night sky, rising shortly after dark. It is in Virgo, a few degrees northeast of Spica. On the 15th, distance is 821 million miles, and it is magnitude 0.6.

URANUS : in Gemini, in the evening sky, sets shortly after midnight. It is still well placed for observation. Magnitude is 6, and apparent diameter 3 1/2". Distance the 15th is 1707 million miles.

NEPTUNE : near Saturn in Virgo, rises as an 8th magnitude object shortly after sunset. Well placed for observation. Distance the middle of the month is 2734 million miles.

EVENING SKY MAP FOR FEBRUARY

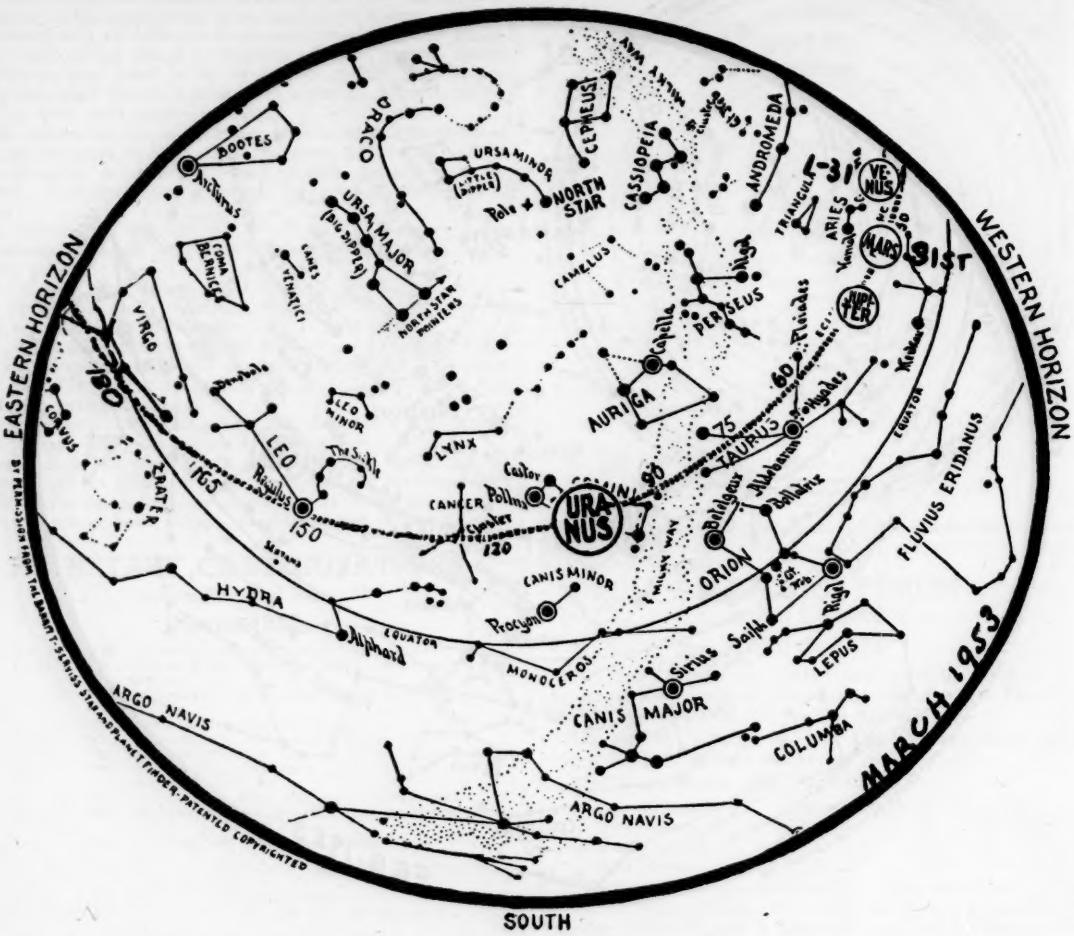


AT 9:00 P.M., FEB.1; 8:00 P.M., FEB. 15; 7:00 P.M., FEB. 28.

This map is arranged specifically for Latitude 40 North—New York—but is practical for ten or fifteen degrees north or south of this latitude anywhere in the United States, the southern portion of Canada and the northern portion of Mexico and for corresponding latitude in Europe.

AT 8:45 P.M., FEB. 1; 7:45 P.M., FEB. 15; 6:45 P.M., FEB. 28. AT 8:45 P.M., MAR. 1; 7:45 P.M., MAR. 15; 6:45 P.M. MAR. 31.

EVENING SKY MAP FOR MARCH



AT 9:00 P.M., MAR. 1; 8:00 P.M., MAR. 15; 7:00 P.M., MAR. 31.

This map is arranged specifically for Latitude 40 North—New York—but is practical for ten or fifteen degrees north or south of this latitude anywhere in the United States, the southern portion of Canada and the northern portion of Mexico and for corresponding latitude in Europe.

THE STARS AND CONSTELLATIONS

Every eye is now drawn irresistibly to the great constellation Orion, situated about an hour east of the meridian. The rising of Orion is one of the most imposing spectacles that the heavens afford. In ancient times the appearance of this constellation was always associated with the coming of the season of storms and tempests. Hesiod wrote:—"then the winds war aloud. And veil the ocean with a sable cloud."

The splendor of his two great first magnitude stars, Rigel in the foot and Betelguese in the shoulder, is alone enough to make this constellation a cynosure for all eyes to say nothing of the marvelous giant. High above, toward the West, blazes the bull, Taurus, with the gleaming cluster of the Pleiades shaking upon his flank and the red Aldebaran aflame in his eye as he rushes down upon Orion. As one looks at the brilliant "Dogstar" flashing all the colors of the spectrum, one cannot help recalling the remarkable history of that star which was worshipped on the banks of the Nile long before Rome had been heard of, and in whose honor were erected temples whose magnificence and magnitude produce astonishment even in this age of architectural extravagance. Directly in the South flowing first Westward from the foot of Orion and then turning Eastward, is Eridanus, (the River). Its stars are so arranged that they produce unmistakably the appearance of a stream in the sky. Away over in the West appears Cetus, (the Whale) one of the most extensive of the constellations, but containing few stars bright enough to attract special attention. The Great Square of Pegasus, is half way down the Western sky. Running Eastward from the corner of the Square is the row of second magnitude stars which mark the figure of Andromeda. East of Andromeda comes Perseus, and Southeast of Perseus, buried in the Milky Way appears Auriga, ornamented with the great white star Capella. Capella is directly North of that constellation to the Pole Star. Southeast of Capella come the twins, Gemini, with the brilliant Procyon, in Canis Major, below them. Still further down in the East, below Gemini, is Cancer (the Crab) remarkable for its glimmering cluster called the "Manger" The Great Dipper, in Ursa Major, stands upright on its handle low down in the Northeast, while Cassiopeia, which always swings round the pole directly opposite to the Dipper, is high up in the Northwest, above Andromeda.

"From all quarters" wrote the Greek poet Aratus whom St. Paul quoted, "the Heavens speak to Man" and surely at no season do they speak more plainly or more eloquently and imposingly than at this season, when they are ablaze with their brightest brilliants.

At the beginning of January the earth is in perihelion, or at its point of nearest approach to the sun. We are now 3,000,000 miles nearer the sun than we were in July, and yet it is winter for us, simply because the Northern hemisphere now leans away from the sun, so that its rays fall slopingly upon us here, and we are consequently spread over so much greater an area that their heating power is less. In the Southern hemisphere the case is exactly reversed, for there the sun's rays now fall more perpendicularly, and a proportionately greater number of them are spread over a given area of the earth's surface. Perpetual night now reigns at the North Pole and perpetual day at the South Pole.

There are several meteoric showers in January, the most remarkable occurring on the nights of the 2nd and 3rd, the radiant point being in the constellation Draco, below the "Little Dipper" which hangs downward from the pole. These meteors move swiftly and in long paths.

CASTOR'S REMARKABLE SYSTEM

The star Castor is a physical sextuple ! It was first found a double in 1719 by the English astronomers Bradley and Pound. (Pound fostered Bradley's interest in astronomy and the two observed together for several years.) The pair may be seen with a telescope magnifying 150 times. They are of second and third magnitude and Olcott called them both greenish white. In 1750 Bradley observed them again and found that their positions had changed. From 1728 to 1803 the star was followed by the elder Herschel and in the latter year he was able to announce that it was physically double. This was the first time that a double star had been shown to obey the laws of gravity. (Herschel coined the word "binary" which we apply to such stars today.)

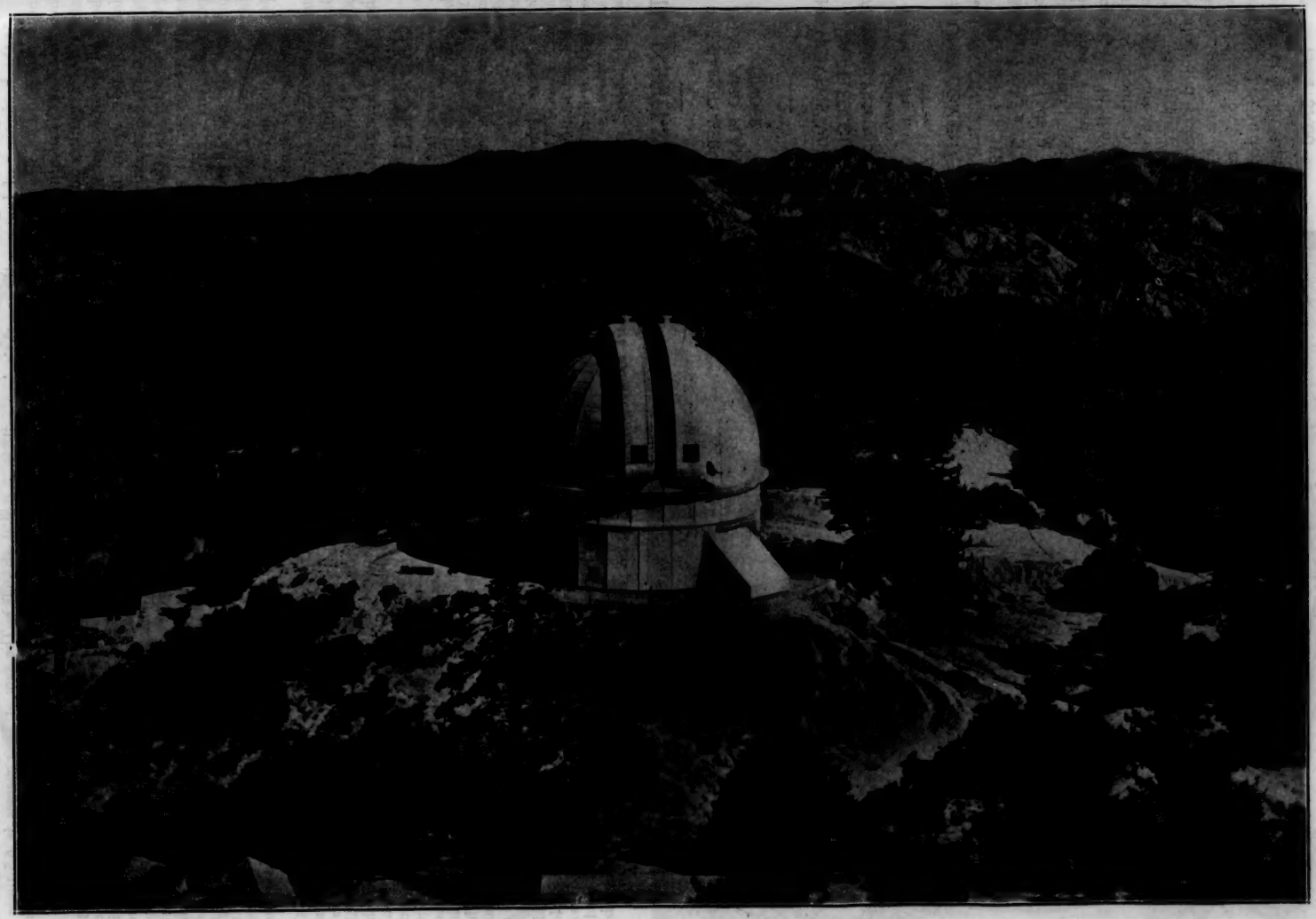
The pair has been followed ever since but its orbit is so large that its period is still unknown. It is probably around 350 years, although it could be nearly as large as 500. The largest diameter of the orbit is probably about 160 astronomical units, four times the mean distance of Pluto from the Sun. (At greatest elongation the pair were six seconds apart. In 1935 their distance was 3.91 seconds.) The sum of their masses is 6.5 times that of the sun. Their luminosities are 23 and 11 times the sun's. Their apparent magnitudes are 1.99 and 2.85 respectively.

These two stars are only the beginning. In 1896 Belopolsky, of Pulkova, found that the fainter of the two was a spectroscopic binary. Then, in 1904, Curtis of the Lick Observatory showed that the same thing is true of the brighter star. Neither of the invisible companions are even bright enough to show spectral lines on the photographic plate. They make their presence known only by the changes in the velocities of the brighter stands along our line of sight as they revolve in their orbits. From this thin evidence we can only deduce that the brighter star has a period of 9.22 days and revolves in a very eccentric ellipse (e is 0.50), while the fainter star travels very nearly in a circle (eccentricity of 0.01) in 2.93 days. We know from this that the masses of the stars in the first system are very unequal, while those in the second are almost alike.

But that is not all the story. About 73 seconds from the brilliant pair there is a reddish ninth magnitude star which shares their motion in space. From this fact we conclude that it is physically related to them, although there is no sign of its revolving in an orbit around them. If it actually is traveling in such an orbit (as is probably the case) its mean distance must be of the order of 950 light years and its period may exceed 10,000 years.

This star, also, is a spectroscopic binary but this time the lines of the faint star are visible. In fact the two stars eclipse each other as they revolve and cause the little red star which they form to vary much in the manner of familiar beta Lyrae. Their masses are equal and probably a little more than half the sun's. Their radii and luminosities are also about half those of the sun. They revolve around each other in 0.814 of a day.

This whole cavalcade is receding from us at three kilometers a second and moving across the sky at thirteen. It includes two very hot stars (the bright pair, both of spectral type A with surface temperatures around 11,000 Centigrade degrees) and one very cool one (the faint red star, whose temperature has been put at 3,650 degrees).



MOUNT WILSON OBSERVATORY
The 100 foot dome from the 150 foot tower